

Applichem



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Applichem Case

Introduction

Applichem was a manufacturer of speciality chemicals founded in Chicago just before the World War II. Most of its products were devised by Applichem's applications engineers as solutions to a specific customer's problems. Applichem's Research department subsequently refined the product and process- in successful cases to arrive at a product with broader application.

Release-ease was a specialty chemical. Applichem developed it in 1952 in response to a customer's request for help in formulating a plastic moulding compound which released easily from metal moulds after compression moulding. It was sold as a dry powder. "Release-ease" was a chemical to be added in low concentration to the plastic moulding compound during its manufacture so that the moulded parts would be easier to separate from the mould and would leave the mould cleaner. Release-ease was widely used in moulding plastic parts.

Applichem manufactured Release-ease in six plants Gary (Indiana) Plant in USA, Canada, Mexico, Frankfurt plant in Germany, Venezuela and Sunchem plant in Japan.

There was a perception in the senior management of Applichem that the Gary[Indiana] plant was inefficient and it would be best if the company manufactured Release-ease in Mexico and Frankfurt. However it was believed to be unfair to compare the Gary Plant which manufactured 19

product families of chemicals with the Frankfurt plant which had a much higher production capacity and enjoyed economies of scale.

Situation Analysis

Table 1 shows the Capacity Utilization and Yield of the Applichem's Release-ease chemical plants. The Applichem's market research group expected little net increase in demand for Release-ease during the next five years. Since the plants are not utilized completely we can conclude that there is no need to install additional capacity but use the existing capacity more efficiently.

Plants

Mexico

Canada

Venezuela

Frankfurt

Gary

Sunchem

Annual Production Volume in 1982

(million pounds)

17.2

2.6

4. 1

38. 0

14. 0

4. 0

Annual Design Capacity

(million pounds)

22. 0

3. 7

4. 5

47

18. 5

5. 0

Utilization

(in percentage)

78. 18%

70. 27%

91. 11%

80. 85%

75. 67%

80%

Average Yield

(in percentage)

94. 7%

91. 1%

91. 7%

98. 9%

90. 4%

98. 8%

Table 1: Capacity Utilization and Yield

Sales

(in million pounds)

Plant

Actual 1982 Production

Exports

by

Region

Imports by

Region

North America

(including Mexico & Canada)

32

Gary

14. 0

14. 2

12. 4

Canada

2. 6

Mexico

17. 2

Western Europe

(incl. Middle East and Africa)

20

Frankfurt

38.9

18.0

0

Latin America

16

Venezuela

4.1

0

11.9

Pacific and Rest of the World

11.9

Sunchem

4.0

0

7.9

Total

79.9

79.9

32.2

32.2

Table 2: Exports and Imports by Region

Table 2 shows that there is considerable amount of imports and exports between the regions. In Latin America and Pacific the local production is much less than demand and hence Release-ease is imported.

Costs: Direct and Indirect costs

The allocation of indirect costs is a problem especially for a plant like Gary since it produces 19 product families and it also designed to manufacture prototype samples for customers. This also adds to the indirect costs.

However to compare the performance of plants it would be advisable to compare the direct and indirect costs of the plants. It is summarized in Table 3

COST PER 100 POUNDS OF RELEASE EASE

Mexico

Canada

Venezuela

Frankfurt

Gary

Sunchem

Raw Material(1)

75. 05

68. 70

87. 29

53. 00

60. 83

91. 86

Direct Labor, Salary & Fringes(2)

2. 38

7. 03

4. 68

5. 78

8. 46

12. 82

Depreciation

0. 95

0. 97

0. 94

1. 05

1. 60

3. 23

Utilities

5. 08

5. 50

5. 96

5. 54

5. 45

10. 49

Maintenance

1. 60

2. 75

2. 17

1. 34

3. 71

3. 77

Quality Control

0. 64

1. 30

1. 81

0. 57

1. 54

2. 77

Waste Treatment

1. 37

0. 96

0. 00

0. 64

1. 02

10. 61

Plant Administration

1. 11

3. 62

4. 58

2. 91

1. 22

4. 07

Development

0. 00

0. 00

0. 00

0. 38

0. 97

2. 48

Supplies

2. 25

0. 98

3.65

0.00

0.77

0.56

Building Expense

0.00

0.00

0.00

1.12

0.64

0.36

Other

2.20

1.44

1.23

1.01

0.29

6. 22

Package, Load, & Ship(3)

2. 38

4. 10

4. 03

3. 35

13. 78

4. 56

Overhead

0. 00

0

0

0. 00

2. 65

0

Total (4)

95. 01

97.35

116.34

76.69

102.93

153.80

Variable Cost (5) = (1) + (2) + (3)

79.81

79.83

96.00

62.13

83.07

109.24

Fixed Cost (6) = (4) - (5)

15.20

17.52

20.34

14.56

19.86

44.56

Production(million lbs)

17.2

2.6

4.1

38

14

4

Installed capacity (million lbs)

22

3.7

4.5

47

18.5

5

Table 3: Costs of manufacturing 100 pounds of Release-ease

A summary glance at table 3 shows that the total cost of manufacturing Release-ease is the highest in Sunchem plant in Japan and the lowest in Frankfurt plant.

Table 3 also lists the variable costs and the fixed cost per 100 pounds of manufacturing. The highest variable cost is in Sunchem plant and the lowest is in Frankfurt plant. The variable cost in Gary plant is \$83. 07 which included the packaging cost of \$13. 78. If we use standard packaging as done in other plants the variable cost will come down to \$73. 4 which compares favourably with Mexican and Canadian Plants.

Costs: Transportation & Import Duties

Costs in \$ per 100lbs

TOà

Mexico

Canada

Venezuala

Frankfurt

Gary

Sunchem

FROM

Mexico

<https://assignbuster.com/applichem/>

0.0

11.4

7.0

11.0

11.0

14.0

Canada

11.0

0.0

9.0

11.5

6.0

13.0

Venezuela

7.0

10.0

0.0

13. 0

10. 4

14. 3

Frankfurt

10. 0

11. 5

12. 5

0. 0

11. 2

13. 3

Gary

10. 0

6. 0

11. 0

10. 0

0. 0

12. 5

Sunchem

14. 0

13. 0

12. 5

14. 2

13. 0

0. 0

Table 4: Transportation Costs among plants

Table 4 shows the transportation costs among plants. This table basically states that to transport 100lbs from Mexico to Canada costs \$11. 4 and to transport 100lbs from Canada to Mexico is \$11. This table is very important in order to optimize the global operations.

The import duty into every country is as given below

Mexico

Canada

Venezuela

Germany

USA

Japan

60%

0%

50%

9.5%

4.5%

6%

Table 5: Import Duties

The level of import duties basically determines the amount to be produced in the respective country. Countries having a high amount of import duties make imports costly.

For the purpose of case analysis the import duties is calculated as follows.

Import duties= (Percentage of import duty)*(Cost of manufacture + Cost of transportation).

For example if we import 100 pounds of Release-ease from Frankfurt to Mexico the import duty is as follows:

$$\text{Import duty} = (0.6) * (76.69 + 10) = \$52.014$$

As we can see import duties add significant amounts to costs of the company.

Costs: Raw materials and Labour

RAW material Costs

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(\$ per pound)

Mexico

Canada

Venezuela

Frankfurt

Gary

Sunchem

A

1. 347

1. 450

1. 280

1. 271

1. 347

1. 548

B

0. 285

0. 298

0. 530

0. 244

0. 251

0. 423

C

0. 293

0. 220

0. 369

0. 180

0. 129

0. 499

D

0. 223

0. 286

0. 366

0. 155

0. 225

0. 219

Table 6: Cost of raw material

Table 6 gives the cost of raw material per pound in each of the plants. The raw material costs is highest for Sunchem plant and is the lowest for the Frankfurt plant.

Cost per hour in \$

Mexico

Canada

Venezuela

Germany

US

Japan

1982

1. 03

8. 33

3. 34

6. 15

8. 50

6. 06

1981

2. 42

7. 77

3. 04

6. 19

7. 99

6. 24

1980

2. 07

6. 88

2. 62

6. 72

7. 27

6. 37

1979

1. 75

6. 36

2. 42

7. 14

6. 69

5. 02

1978

1. 51

5. 75

2. 30

6. 41

6. 17

5. 83

1977

1. 31

5. 85

2. 03

5. 30

5. 68

4. 42

Table 7: Labour Cost per hour

Table 7 gives the labour cost per hour. Labour is the cheapest in Mexico but costliest in US. The labour cost per hour in Frankfurt plant is 25% less than the labour cost in US

Case Questions

1. Compare the performance of Applichem's 6 Release-ease plants

Since each of Applichem's 6 Release ease plants have different raw material and labour costs as well as different capacities, it will be incorrect to just compare the total cost of manufacturing. We believe the best way to compare operating performance is to normalize the costs (raw material & labour) across plants as well as to divide the costs into fixed and variable costs.

Mexico

Canada

Venezuela

Frankfurt

Gary

Sunchem

Variable Cost for 100lbs (in \$)

79. 81

79. 83

96. 00

62. 13

83. 07

109. 24

Fixed Cost for 100lbs (in \$)

15. 20

17. 52

20. 34

14. 56

19. 86

44. 56

Total Cost for 100lbs (in\$)

95. 01

97. 35

116. 34

76. 69

102. 93

153. 80

Production(in million lbs)

17. 2

2. 6

4. 1

38

14

4

Total Fixed Cost in (\$10, 000)

261. 44

45. 552

83. 394

553. 28

278. 04

178. 24

Installed capacity(in million lbs)

22

3. 7

4. 5

47

18. 5

5

Fixed Cost/Capacity

11. 88

12. 31

18. 532

11. 77

15. 03

35. 65

Table 8: Analysis of Costs across plants

Table 8 is derived from Table 3. We can see that the Variable cost is the highest in the Sunchem plant and the lowest in the Gary Plant. The variable cost for the Gary plant includes the packaging cost \$13. 78. If the Gary plant uses the standard 50lb packaging then we can expect the packaging cost to

be \$4. 1 per hundred pounds instead of \$13. 78. So the variable costs per 100lbs will drop from \$73. 39 which compares favourably with the Mexican plant although the Mexican plant has higher capacity. The variable costs of the Frankfurt class is less because of the lower cost of raw materials (Table 6) and the relatively lower labour costs when compared to the Gary plant. If we normalize the labour cost and the raw material costs across the Gary and the Frankfurt we see that the cost comparison for the Gary plant is much more favourable. The fixed costs across the plants are normalized by finding the approximate total fixed cost and dividing it by the installed capacity. The lowest fixed cost for capacity is in Frankfurt and the highest in the Sunchem plant in Japan. Contrary to perceptions the Gary plant compares reasonably with the other “ high” performance plants.

Mexico

Canada

Venezuela

Frankfurt

Gary

Sunchem

Production (in million lbs)

17. 2

2. 6

4. 1

38

14

4

Capacity (in million lbs)

22

3. 7

4. 5

47

18. 5

5

Capacity Utilization (%)

78. 18

70. 27

91. 11

80. 85

75. 68

80

Yield (%)

94.7

91.1

91.7

98.9

90.4

98.8

No. of product families other than release ease

6

4

1

12

19

1

Table 9: Other parameters of comparison

The capacity utilization of Frankfurt plant is quite high leading to further reduction in costs per pound of release ease. The yield of the Gary plant

compares unfavourably for the plants of its size. This may be due to the old equipment used or the variety of product families produced at the Gary plant.

2. Why were some plants performances “ better” than others?

The reasons why the performance of some plants were better than the others were

1. Lower cost of raw materials: From table 6 we see that the raw material costs for some of the plants are higher than the other leading to increased production costs.
2. Economies of scale: With larger production capacity the yield increases and the raw material usage is also more efficient. The percentage of fixed cost as a percentage of the total cost decreases
3. Lower labour costs: The labour cost per hour in Mexico is approximately 1/8th as that of the US plant leading to lower costs
4. External factors: Exchange rate fluctuations, environmental regulations in Japan, import duties may lead to a relative decline in performance when compared to other plants.
5. Variety of operations: The Gary plant produces about 19 product families and there were also difficulties in accurately measuring the indirect costs. This may lead to higher costs and inefficiencies when compared to the Frankfurt plant.

6. Capacity Utilization: The Frankfurt plant is run at a higher utilization rate leading to unit cost reduction and higher efficiency and less wastage.

3. How would you advise Joe Spandro to configure his worldwide manufacturing system?

We can formulate a linear programming problem to optimize the worldwide manufacturing system.

Linear Program Formulation

Let,

x_{ij} indicates the amount in million pounds of Release Ease produced by i th plant for j th plant

y_{ij} indicates the total cost of producing 100 pounds of Release Ease produced by i th plant for j th plant

D_i indicates the demand for i th plant

S_i indicates the maximum capacity for i th plant

where $i, j = 1, 2, 3, 4, 5, 6$

Where

1

Mexico

2

Canada

3

Venezuela

4

Frankfurt

5

Gary

6

Sunchem

Objective: Minimize $\sum_{i,j} c_{ij} x_{ij}$

Subject to:

$$\sum_{j} x_{ij} \leq S_i$$

$$\sum_{i} x_{ij} \geq D_j$$

x_{ij}, y_{ij} are non negative

Cost optimized Linear Programming output to meet demand within capacity constraints

From/To

Mexico

Canada

Venezuela

Frankfurt

USA

Japan

Mexico

95. 01

106. 41

153. 015

116. 08095

110. 7805

115. 5506

Canada

173. 36

97. 35

159. 525

119. 19075

108. 0008

116. 971

Venezuela

197. 344

126. 34

116. 34

141. 6273

132. 4433

138. 4784

Frankfurt

138. 704

88. 19

133. 785

76. 69

91. 84505

95. 3894

Gary

180. 688

108.93

170.895

123.65835

102.93

122.3558

Sunchem

268.48

166.8

249.45

183.96

174.306

153.8

Table 10: Cost of manufacturing and transporting from plant to plant

Cost optimized Linear Programming output to meet demand within capacity constraints:

From/To

Mexico

Canada

USA

Frankfurt

Venezuela

Japan

Output

Mexico

22

0

0

0

0

0

22

Canada

0

3.7

0

0

0

0

3.7

Venezuela

0

0

0

0

4.5

0

4.5

Frankfurt

0

3.6

0

20

11.5

11.9

47

Gary

0

0

2.7

0

0

0

2.7

Sunchem

0

0

0

0

0

0

0

Demand

32

20

16

11.9

79.9

Table 11: Optimum production structure with the present cost structure

This solution basically says that the Gary plant should be run at very low capacity and the Sunchem plant in Japan should stop producing Release-ease. However if we are able to standardize the packaging at the Gary plant the cost will come down to \$93.25. Plugging the new numbers in the linear programming model we get the following solution.

From/To

Mexico

Canada

USA

Frankfurt

Venezuela

Japan

Output

Mexico

9.9

0.0

0.0

0.0

0.0

0.0

9.9

Canada

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Venezuela

0.0

0.0

4.5

0.0

0.0

0.0

4.5

Frankfurt

0.0

3.6

11.5

20.0

0.0

11.9

47.0

Gary

0.0

0.0

0.0

0.0

18.5

0.0

18.5

Sunchem

0.0

0.0

0.0

0.0

0.0

0.0

0.0

Demand

32

20

16

11.9

79.9

Table 12: Optimum production structure by standardizing packaging at the Gary plant.

The new solution says that we have to run the Gary plant at full capacity and stop production at both the Canadian and the Japanese plants.

This solution makes sense when we examine the input costs as the input costs at the Canadian and the Japanese plants are the highest.

Recommendations:

1. Standardize the packaging at the Gary Plant so that the packaging costs are minimized.
2. Stop production of Release-ease at the Canada and the Japanese plants.
3. Run the Frankfurt, Gary and the Venezuelan plant at full capacity.
4. Any additional requirement for extra capacity can easily be satisfied by the Mexican plant.

5. Explore the option of solid recovery and waste treatment practices should be employed across all the plants.

6. The laboratory facilities in the Japanese plant should be used if possible for prototype samples to customers.

7. Some of the product families which are produced in low quantities can be shifted to the Canadian plant.

8. Improve the cost accounting processes so that the indirect costs of each product line are appropriately accounted.